

Physicochemical and Phytochemical Analysis of Different Parts of Indian Kesar Mango—A unique variety from Saurashtra Region of Gujarat

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ABSTRACT

The aim of the present study was to evaluate physicochemical and phytochemical analysis of different parts (ripe seed, unripe seed, ripe peel, unripe peel and stem) of Indian mango (var. 'Kesar') collected from Saurashtra region of Gujarat. The physicochemical properties such as loss on drying, total ash value, acid insoluble ash value, water soluble ash value and extractive values were carried out. The phytochemical properties such as alkaloids, flavonoids, tannins, phlobatanins, triterpenes, steroids, saponins and cardiac glycosides were also carried out. In phytochemical analysis, tannins showed maximum amounts in all five parts. The present study provides the details physicochemical and phytochemical properties of different parts of kesar mango which are useful in laying down standardization

and pharmacopeia parameters.

Key words: Kesar Mango, Physicochemical parameters, Phytochemical analysis, Ripe and Unripe Peel, Ripe and Unripe Seeds, Stem.

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INTRODUCTION

The plant kingdom has been the safeguard for the survival of the humans throughout recorded history. Plants have been the basis of many traditional medicine systems throughout the world for thousands of years and continue to provide mankind with new remedies. The research on plants of medicinal importance is rapidly increasing at National and International level.¹⁻³ Use of plants as a source of medicine has been inherited and is an important component of the health care system in India.

In the Indian systems of medicine, most practitioners formulate and dispense their own recipes; hence this requires proper documentation and research. In western world also, the use of herbal medicines is steadily growing with approximately 40% of population use herbs to treat medical illnesses.^{4,5} Public, academic and government interest in traditional medicines is growing exponentially due to the increased incidence of the adverse drug reactions and economic burden of the modern system of medicine.⁶ The *Charaka Samhita* (1000 B.C.) mentions the use of over 2000 herbs for medicinal purposes.⁷ It has continued to be used not only for primary health care of the poor in developing countries, but also in countries where conventional medicine is predominant in the national health care system.

The medicinal properties of plants are due to some chemical substances that produce certain definite physiological action on the human body. These non-nutritive components are called phytochemicals. The qualitative analysis as well as quantification of phytochemicals of a medicinal plant is regarded as vital step in any kind of medicinal plant research. Mango (*Mangifera indica* L.) belonging to the family Anacardiaceae, is one of the major fruit crops in India. Besides fruit yielding, this plant is used for various other therapeutically purposes. Present study was conducted on physicochemical and phytochemical analysis on the different parts of the local variety 'Kesar' of the Mango (*Mangifera indica* L.). According to previous published data in same plant parts, exhibited a

considerably high antimicrobial activity against the tested pathogenic microorganisms as well as better antioxidant activity as compared that of the standard.⁸⁻¹¹ This biological activity due to the presence of phytochemical in mango plant. Therefore the present study is to analyses physicochemical parameters and preliminary phytochemical investigation to characterize the plant material. In our study, Kesar variety was selected because uniqueness of Gir kesar mango is due to colour, taste of pulp is sweet and fibreless and produce special aroma are unique and popular in Saurashtra region of Gujarat, India. To the best of our knowledge phytochemical and physicochemical analysis of different parts of mango (var. Kesar) have never been comparatively evaluated in this variety.

MATERIAL AND METHODS

Collection of plant material

Mangifera indica L. var. Kesar fruits and stem were collected from Saurashtra region, Gujarat, India in the month of May 2010. The plant was compared with voucher specimen (Voucher specimen No. SU/BIO/514/Thakrar) deposited at Department of Biosciences, Saurashtra University, Rajkot, Gujarat, India. The parts were separated, washed thoroughly with tap water, shade dried, homogenized to fine powder and stored in air tight bottles.

Chemicals, reagents and solvents

All chemicals, reagents and solvents used during the experimentation were of analytical grade.

Physicochemical study

Determination of loss on drying

Two grams of crude powder was taken in an evaporating dish and then dried in an oven at 105°C till constant weight was obtained. The weight after drying was noted and loss on drying was calculated. The percentage was calculated on the basis of sample taken initially.¹²

Determination of total ash

Two grams of dry powder was taken in a silica crucible and heated gradually increasing the heat to 500°C until it was white, indicating the absence of carbon. Ash was cooled in a desiccator and weighed without delay. Total ash value was calculated as mg g⁻¹ of air-dried material.¹²

Determination of water soluble ash

To the crucible containing the total ash, 25 ml of water was added and boiled for 5 min. The insoluble matter was collected on an ash less filter paper. It was washed with hot water and heated in a crucible for 15 min. Weight of insoluble matter was subtracted from the weight of total ash. The content of water soluble ash was calculated in mg g⁻¹ of air dried material.¹²

Determination of acid insoluble ash

Twenty five ml of hydrochloric acid (70 g L⁻¹) was added to the crucible containing total ash. It was covered with a watch-glass and heated gently for 5 min to boil. The watch-glass was rinsed with 5 ml of hot water and this liquid was added to the crucible. The insoluble matter was collected on an ash less filter paper and it was washed with hot water until the filter was neutral. The filter paper containing the insoluble matter was transferred to the original crucible; it was dried on a hot plate and heated till constant weight was obtained. The residue was allowed to cool in desiccators for 30 minutes and then weighed without delay. Acid insoluble ash was calculated in mg g⁻¹ of air dried material.¹²

Determination of petroleum ether soluble extractive value

Five grams of dried powder was taken in 100 ml of petroleum ether in a conical flask, plugged with cotton wool and then kept on a rotary shaker at 120 rpm for 24 h. Thereafter, it was filtered and the filtrate was evaporated to dryness at 105°C till constant weight was obtained. The percentage of extractable matter was calculated with reference to the sample taken initially.¹²

Determination of methanol soluble extractive value

Five grams of dried powder was taken in 100 ml of methanol in a conical flask, plugged with cotton wool and then kept on a rotary shaker at 120 rpm for 24 h. Thereafter, it was filtered and the filtrate was evaporated to dryness at 105°C till constant weight was obtained. The percentage of extractable matter was calculated with reference to the sample taken initially.¹²

Determination of acetone soluble extractive value

Five grams of dried powder was taken in 100 ml of acetone in a conical flask, plugged with cotton wool and then kept on a rotary shaker at 120 rpm for 24 h. Thereafter, it was filtered and the filtrate was evaporated to dryness at 105°C till constant weight was obtained. The percentage of extractable matter was calculated with reference to the sample taken initially.¹²

Determination of water soluble extractive value

Five grams of dried powder was taken in 100 ml of water in a conical flask, plugged with cotton wool and then kept on a rotary shaker at 120 rpm for 24 h. Thereafter, it was filtered and the filtrate was evaporated to dryness at 105°C till constant weight was obtained. The percentage of extractable matter was calculated with reference to the sample taken initially.¹²

Qualitative phytochemical analysis

The crude powder of different parts was subjected to qualitative phytochemical analysis.¹³⁻¹⁵

Alkaloids

The crude powder was dissolved in 2 N HCl. The mixture was filtered and the filtrate was divided into 3 equal portions. One portion was treated with a few drops of Mayer's reagent; one portion was treated with an equal amount of Dragendorff reagent and the other portion was treated with an equal amount of Wagner's reagent. The creamish precipitate, orange precipitate and brown precipitate indicated the presence of respective alkaloids.¹⁶

Flavonoids

Alkaline reagent test was performed for checking the presence of flavonoids. The crude powder was treated with a few drops of diluted sodium hydroxide (NaOH) separately. Formation of intense yellow color which turned colorless on addition of a few drops of diluted HCl indicated the presence of flavonoids.

Tannins

The crude powder was treated with alcoholic ferric chloride (FeCl₃) reagent. Blue color indicated the presence of tannins.¹⁷

Phlobatanins

The crude powder was boiled with 1% aqueous HCl. Deposition of red precipitate was taken as evidence of the presence of phlobatanins.¹³

Triterpenes

Chloroform extract of the crude powder was treated with concentrated sulphuric acid (H₂SO₄). Appearance of reddish brown ring indicated the presence of triterpenes.¹³

Steroids

Liebermann-Burchard reaction was performed for checking the presence of steroids. A chloroformic solution of the crude powder was treated with acetic anhydride and a few drops of concentrated H₂SO₄ were added down the sides of the test tube. A blue green ring indicated the presence of steroids.

Saponins

The presence of saponins was determined by Frothing test. The crude powder was vigorously shaken with distilled water and was allowed to stand for 10 min and classified for saponin content as follows: no froth indicates absence of saponins and stable froth of more than 1.5 cm indicated the presence of saponins.¹⁸

Cardiac glycosides

Keller-kiliani test was performed for checking the presence of cardiac glycosides. The crude powder was treated with 1.0 ml mixture of 5% FeCl₃ and glacial acetic acid (1:99 v v⁻¹). To this solution, a few drops of concentrated H₂SO₄ were added. Appearance of greenish blue colour within few minutes indicated the presence of cardiac glycosides.¹⁹

Statistical analysis

Each sample was analyzed individually in triplicate and the results are expressed as the mean value (n = 3) ± Standard Error of Mean (S.E.M.).

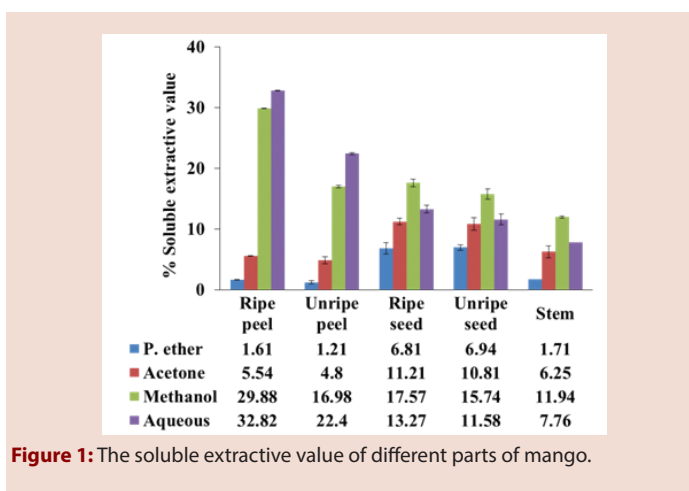
Table 1: Physicochemical parameters of different parts of mango.

Parts name	Loss on drying	Total ash	Water soluble ash	Acid insoluble ash
Ripe peel	8.5 ± 0.00	4.33 ± 0.60	8.34 ± 0.29	7.91 ± 0.29
Unripe peel	7.5 ± 0.00	2.83 ± 0.17	7.9 ± 0.54	7.4 ± 1.60
Ripe seed	8.5 ± 0.00	2.33 ± 0.17	8.92 ± 0.42	8.16 ± 0.93
Unripe seed	8.17 ± 0.44	2.50 ± 0.76	8.12 ± 0.25	7.83 ± 0.60
Stem	7.95 ± 0.29	3.56 ± 1.25	6.53 ± 0.54	5.98 ± 0.23

Table 2: Qualitative phytochemical analysis of different parts of mango

Phytochemicals	Test	Stem	Ripe peel	Unripe peel	Ripe seed	Unripe seed
Alkaloids	Dragendroff's test	+++	+++	+	-	++
	Mayer's test	-	-	-	-	-
	Wagner's test	+++	+	+	-	-
Flavonoids	Alkaline reagent	++	++	+	+	+
	Tannins	FeCl ₃ test	+++	+++	+++	+++
Phlobatanins	HCl test	++	++	++	-	+
Triterpenes	H ₂ SO ₄ test	++	++	++	+++	+
Steroids	Liebermann-Burchard test	-	-	-	-	-
Saponins	Frothing test	-	-	+	-	-
Cardiac glycosides	Keller-kilianni test	+++	-	++	-	-

–: Absent; +: Less present; ++: Moderate present; +++: High present.

**Figure 1:** The soluble extractive value of different parts of mango.

RESULTS AND DISCUSSION

Physicochemical parameters

The physical constant evaluation of the drugs is an important parameter in detecting adulteration or improper handling of drugs. Physicochemical characterization of powder of studied part is shown in Table 1. The all parts showed less moisture content; it was range from 7.5-8.5%. Moisture content of drugs could be at minimal level to discourage the growth of bacteria, yeast or fungi during storage. It can serve as a valuable source of information and provide appropriate standards to establish the quality of this plant material in future study or application.

The ash value was determined by three different forms viz., total ash, water soluble ash and acid insoluble ash. The total ash and loss on drying

were found in range between 2.33% -4.33% and 7.5-8.5 % respectively while water soluble ash and acid insoluble ash was range from 6.53 - 8.92% and 5.98 –8.16% respectively. Ash values are used to determine quality and purity of crude drug. It indicates presence of various impurities like carbonate, oxalate and silicate. The water soluble ash is used to estimate the amount of inorganic compound present in drugs. The acid insoluble ash measures the amount of silica present; especially sand and it indicate contamination with earthy material. Water soluble ash is the water soluble portion of the total ash. Less amount of these three parameters indicate that the inorganic matter and silica were less in mango parts.

Soluble extractive value

The extractive value of different parts of mango is shown in Figure 1. The maximum extractive value was found in water solvent minimum was in petroleum ether. In all studied parts soluble extractive values found in rank is petroleum ether < acetone < methanol < aqueous. The extractive values are useful to evaluate the chemical constituents present in the crude drug and also help in estimation of specific constituents soluble in a particular solvent.^{8,20-22}

Qualitative phytochemical analysis

Medicinal plants are long being used as remedies for various diseases in human. Phytochemical analysis of plant revealed the presence of constituents which are known to exhibit medicinal as well as action on the human body.^{23,24} Phytochemical analysis shows the presence of many medicinally important secondary metabolite types of phytoconstituents like alkaloids, cardiac glycosides, saponins, triterpenes, which indicates that the plant possesses high profile values and can be used to treat various kinds of diseases. The presence of these secondary metabolites suggests that the plant might be medicinal importance. The results of qualitative

phytochemical analysis of the crude powder of different parts of mango are shown in Table 2. All parts had maximum tannins while a steroid was absent.

The qualitative phytochemical investigation gave valuable information about the different phytoconstituents present in the plant, which helps the future investigators regarding the selection of the particular extract for further investigation of isolating the active principle.²⁵ And also gave idea about different phytochemicals have been found to possess a wide range of activities, which may help in protection against chronic diseases. For example, alkaloids protect against chronic disease. Tannins protect from different diseases and disorders caused by microbial infections and free radicals.²⁶⁻²⁸ The biological properties of many plants are due to the phenolic compounds present in them.^{8,11} Physicochemical and phytochemical analysis of leaf and pulp were reported in similar mango variety.^{10,15,29}

The plants thus find their medicinal values due to the presence of respective phytochemical constituents. The presence of various phytochemicals in the tested plant reveals that this plant may be a good source for production of new drugs for various ailments.

CONCLUSION

In phytochemical analysis, tannins showed maximum amounts. The present study provides physicochemical and phytochemical details of the five parts of mango which are useful in laying down standardization and pharmacopoeia parameters. As there is no physicochemical and phytochemical work of five parts of mango at a time on comparative record of this traditionally much valued drug, the present work was taken up with a view to lay down standards, which could be useful to establish the authenticity of this medicinally useful plant. Thus, these plants can be used for further studies to find more about their pharmacological benefits and their potential against fighting various ailments and diseases.

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CONFLICT OF INTEREST

Authors declare, there is no conflict of interest.

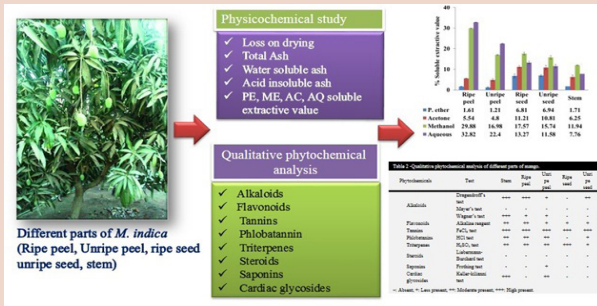
ABBREVIATIONS USED

FeCl₃: Ferric chloride; **HCl**: Hydrochloric acid; **H₂SO₄**: Sulphuric acid; **NaOH**: Sodium hydroxide.

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PICTORIAL ABSTRACT



SUMMARY

- Different parts of kesar mango were selected for the analysis of physico-chemical and phytochemical properties.
- Ripe peel shown the maximum extractive values in aqueous followed by methanol.
- Tannins observed maximum in all parts rather than other phytochemicals.
- This study is useful in laying down standardisation and pharmacopeia parameters for kesar mango.

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